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(54) Built-in refrigerator with increased internal volume

(57) A built-in refrigerator adapted to be mounted in a cabinet of a kitchen or the like, comprises a refrigerator body (R) having a cavity for food conservation and a plurality of reinforcing vertical rod-shaped elements (12,14) adapted to be installed between vertical side panels (10) of the cabinet and the refrigeration body (R) in order to allow the use of side panels (10) having reduced thickness.

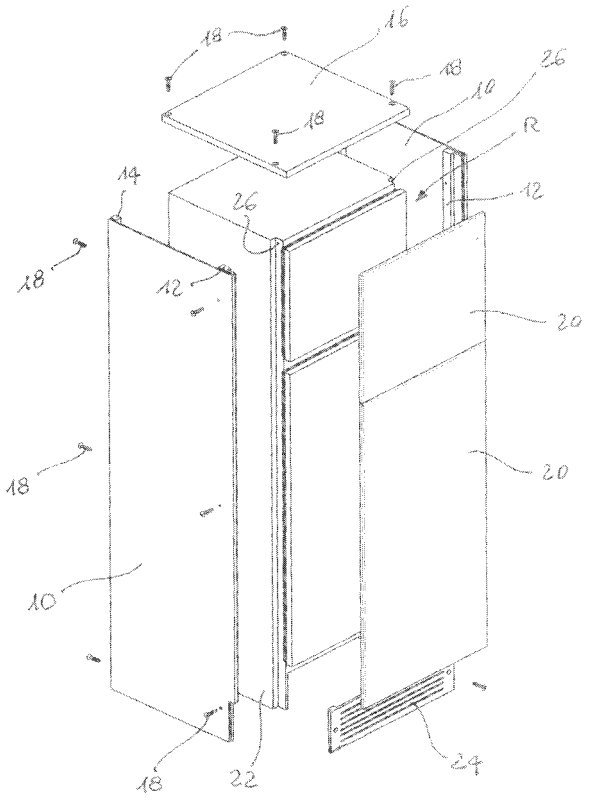

Fig.1

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Description

[0001] The present invention relates to a refrigerating appliance, of the type to be built in a cabinet of a kitchen or the like, comprising a refrigerator body having a cavity for food conservation.

[0002] It is well known in the art of refrigerating appliances (i.e. refrigerators, freezer and the like) the advantage of having built-in refrigerators that are installed in a cabinet as a furniture, looking to be an integral part of the kitchen or of the living room. On the other hand a disadvantage of built-in refrigerators and freezers is the reduce volume of the cavity thereof, since such volume is not only decreased by the thickness of the insulation walls of the refrigerator body, but also of the thickness of the cabinet walls in which the built-in refrigerator has to be installed.

[0003] The width of a built-in refrigerator body is at least 50 mm narrower than a freestanding cabinet of the same category/module (with category it is meant the footprint area on the floor including the enclosure of the kitchen column: total width x total depth), and this is indicative of how is relevant the loss of internal volume.

[0004] A first method to increase the volume of the refrigerator body (and therefore the volume of the cavity thereof) is to increase its width by designing a kitchen cabinet (called also as "column") with very thin vertical walls, something like 2 - 4 mm instead of 18 - 20 mm of the traditional walls. As consequence of these thin walls, a lack of structural stiffness of the cabinet will result, also with related problems in providing a stiff support for the hinges of the furniture wooden doors coupled to the refrigerator thermally insulated doors.

[0005] A second method to increase the volume of the refrigerator body is to increase its height, but this creates big problems in term of accessibility of food products placed in the upper shelves of the cavity.

[0006] It would thus be desirable, and this is the aim of the present invention, to improve the construction of such refrigerators by providing them with means for increasing the volume of the cavity of the refrigerator body.

[0007] According to a first embodiment of the invention, such means comprises a plurality of reinforcing vertical rod-shaped elements adapted to be installed between vertical side panels of the cabinets and the refrigerator body in order to allow the use of thin side panels, without any risk of loosing structural stiffness of the cabinet. According to the invention, said rod-shaped elements are installed substantially in correspondence of each vertical corner of the refrigerator body.

[0008] According to a second embodiment of the invention, said means for increasing the volume of the cavity comprises a suspended tray-shaped support fixed on the bottom of the refrigerator body and adapted to contain functional components of the refrigerating appliance, such as the compressor, the condenser, the cooling fan and the like, the refrigerator body being supported on edges of a cut-out provided in a bottom wall of the cabinet. Thanks to the solution according to this second embodiment of the invention the volume of the cavity is increased either "vertically" or "horizontally", in the sense that it is exploited the volume of what is usually the air suction passage of the built-in assembly and that it is also exploited the volume where the condenser is usually placed (between the back side of the refrigerator and the wall). In other words, by providing a cut-out in the base plate of the furniture cabinet, it is possible to increase the volume of the cavity by placing the "machine room" (i.e. the space where functional components are placed) below the usual level, and by providing an air passage directly in and out of the tray shaped support.

[0009] The invention and the embodiments thereof will be better appreciated from the following description given solely by way of non-limiting example and with reference to the accompanying drawings in which:

- figure 1 is a perspective exploded view of a refrigerator according to a first embodiment of the invention;
- figure 2 is a perspective view of the refrigerator of figure 1, in which the door and the bottom grill have been removed for sake of clarity;
- figure 3 is a horizontal cross section of the refrigerator of figure 1;
- figure 4 is a perspective exploded view of a cabinet for a refrigerator according to a second embodiment of the invention; and
- figure 5 is a side cross section of the second embodiment of the refrigerator according to the present invention, installed in the cabinet of figure 4.

[0010] With reference to figure 1-3, a first embodiment of the present invention shows a method to increase the internal volume of the refrigerator by providing structural stiffness of the kitchen cabinet having very thin panels, combined to an original design of the external geometry of the refrigerator body.

[0011] According to such embodiment, the kitchen cabinet is only a "virtual" one. Practically it is made by two vertical thin side panel 10 having two pillars each, one on the front side, indicated with reference 12, and the other on the back, indicated with the reference 14. A top panel 16 completes the cabinet or "column". The side panels 10 and the top panel 16 are directly fixed on the lateral walls of the refrigerator body R by means of screws 18 flash with the surface, even if other means can be used too (for instance glue). The screws 18 are placed in correspondence of the pillars 12 and 14, and the heads thereof are hidden in a known manner (for instance by means of wooden plugs). The top panel 16 lies on top of the lateral panels 10. The finishing of the visible sides of the panels 10 and front pillars 12 is the same of the rest of the kitchen furniture. The wooden door/s 20 (with the same style of the rest of the kitchen) is/are hinged to the front pillars 12.

[0012] The body R of the refrigerator has two bottom extensions 22 that have the function of replacing the

"legs" of the traditional cabinet or column. Such extensions 22 are supported directly by the floor. On the front of the extensions 22 a grid 24 is fixed for ventilation of the sealed system.

[0013] The front vertical corners of the refrigerator cabinet have each a recess 26 to accommodate the front pillars 12. The back pillars 14 lay on the back side of back vertical corners 28 of the refrigerator body R and of back portions of side panels 10. Each thin panel 10 is in direct contact with the vertical surfaces of the refrigerator body R. In this way the width of the refrigerator cabinet increases more than 50 mm reflecting a relevant increasing of the internal volume, i.e. the increase of the volume for a built-in refrigerator high 1750 mm is around 40 litres.

[0014] With reference to figures 4 and 5 it is shown a second embodiment of the invention in which the cabinet, as far as the thickness of the side panels is concerned, is similar to the usual cabinets used up to now for built-in refrigerators. Typically the refrigerator body of a built-in domestic refrigerating appliance has the same structure and configuration of a free standing refrigerator. This means to have the condensing unit on the back of the refrigerator body and the compressor in a space provided under the refrigerator cavity, supported by a mounting plate located at the same level of the bottom side of the cabinet. All the built-in refrigerator body is mounted in a base plate of the furniture cabinet. Since the base plate of the cabinet is usually from 160 to 300 mm from the floor, this means a relevant loss of internal volume of the built-in refrigerator in comparison with a free standing one of the same height (assuming that the twop kinds of cabinets have the same width and depth).

[0015] According to the invention, the cabinet 100 has a base plate which is provided with a cut-out 102 that occupies most of its surface. The dimension of such cut-out is slighly higher than the dimension of a tray-shaped bottom protrusion 104 (figure 5) placed on the bottom of the refrigerator body R. The size of the protrusion is slightly less than the refrigerator body foot-print. Typically for a foot print of 540 x 540 mm of the refrigerator body, the protrusion 104 is around 450x500 mm with a height of around 160 mm. In the protrusion the funtional components of the refriogerator are contained, such as a condenser C, a compressor K and a cooling fan F (figure 5). The cut-out 102 defines a sort of U-shaped edge 106 on which the refrigerator body R is supported by means of adjustable legs or levellers 108. The refrigeration body R is adapted to be slided in the cabinet 100 and fixed in the same way of a traditional built-in refrigerator.

[0016] According to this second embodiment of the invention the cavity of the refrigerator is at leats 50 mm deeper than in the usual configuration. For a refrigerator 1,8 metre tall, the internal volume increases by 35 - 40 litres. Since the compressor K is installed in the same protrusion with the condenser C, it is possible to eliminate the so-called "dog house" that presently protrudes inside the cavity. This means another volume increase of about 10 litres.

[0017] On the front of the cabinet 100 a louver 115 is mounted to allow the ventilation of condenser and compressor placed in the protrusion. Moreover a structural cross bar 116 is mounted on the cabinet 100 in order to tie the front sides of the cabinet and for providing structural stiffness.

Claims

1. A refrigerating appliance, of the type to be built in a cabinet (10, 16, 100) of a kitchen or the like, comprising a refrigerator body (R) having a cavity for food conservation, **characterised in that** it comprises means (12, 14, 104, 106) for increasing the volume of said cavity.

2. A refrigerating appliance according to claim 1, **characterised in that** said means comprises a plurality of reinforcing vertical rod-shaped elements (12, 14) adapted to be installed between vertical side panels (10) of the cabinet and the refrigeration body (R) in order to allow the use of side panels (10) having reduced thickness.

3. A refrigerating appliance according to claim 2, **characterised in that** said rod-shaped elements (12, 14) are installed substantially in correspondence of each vertical corner (28) of the refrigerator body (R).

4. A refrigerating appliance according to claim 3, **characterised in that** it comprises two front rod-shaped elements (12) placed in recesses (26) of the refrigerator body (R) and two rear rod-shaped elements (14) placed on a rear wall of the refrigerator body (R) and in contact with the vertical side panels (10) of the cabinet.

5. A refrigerating appliance according to claim 3 or 4, **characterised in that** it comprises a door (20) of the cabinet hinged to a rod-shaped element (12) on the front side of the appliance.

6. A refrigerating appliance according to any of the claims 2-5, **characterised in that** the refrigeration body (R) comprises side walls (22) adapted to be supported directly by the floor.

7. A refrigerating appliance according to any of the claims 2-5, **characterised in that** the vertical side panels (10) are fixed to the refrigerator body (R) by means of fastening means (18)

8. A refrigerating appliance according to claim 7, **characterised in that** such fastening means comprises screws (18) placed in correspondence of the rod-shaped elements (12, 14).

9. A refrigerating appliance according to claim 1, **characterised in that** said means comprises a suspended tray-shaped support (104) fixed on the bottom of the refrigerator body (R) and adapted to contain functional components of the appliance such as compressor (K), condenser (C) and fan (F), the refrigerator body (R) being supported on edges (106) of a cut-out (102) provided in a bottom wall of the cabinet (100).

10. A refrigerating appliance according to claim 9, **characterised in that** the refrigerator body (R) comprises adjustable legs (108) placed on said edges (106) of the cut-out (102).

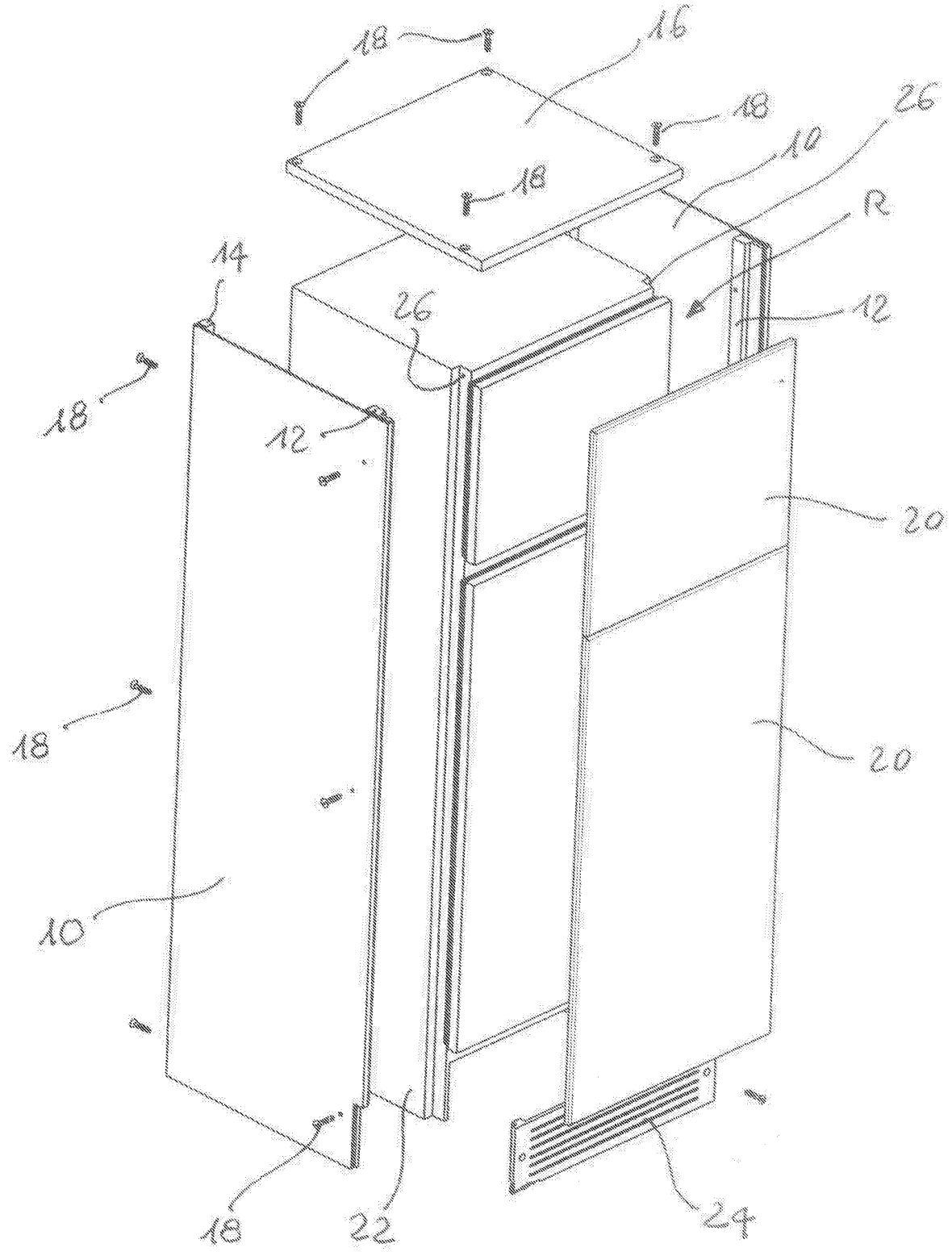

Fig. 1

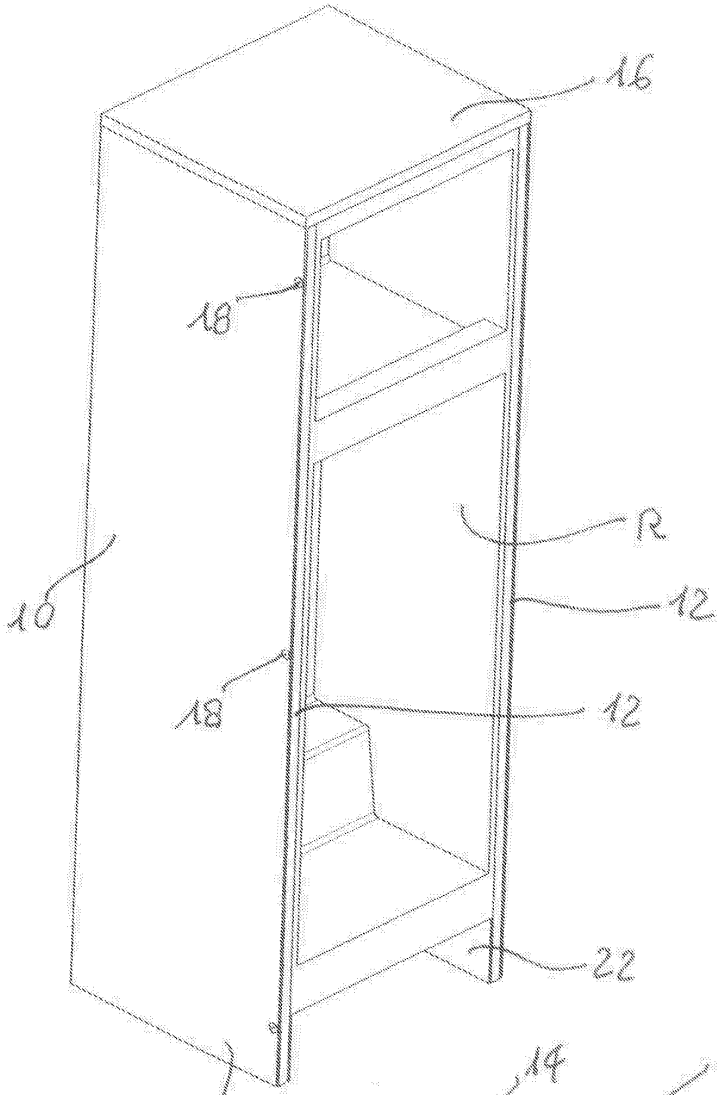

Fig. 2

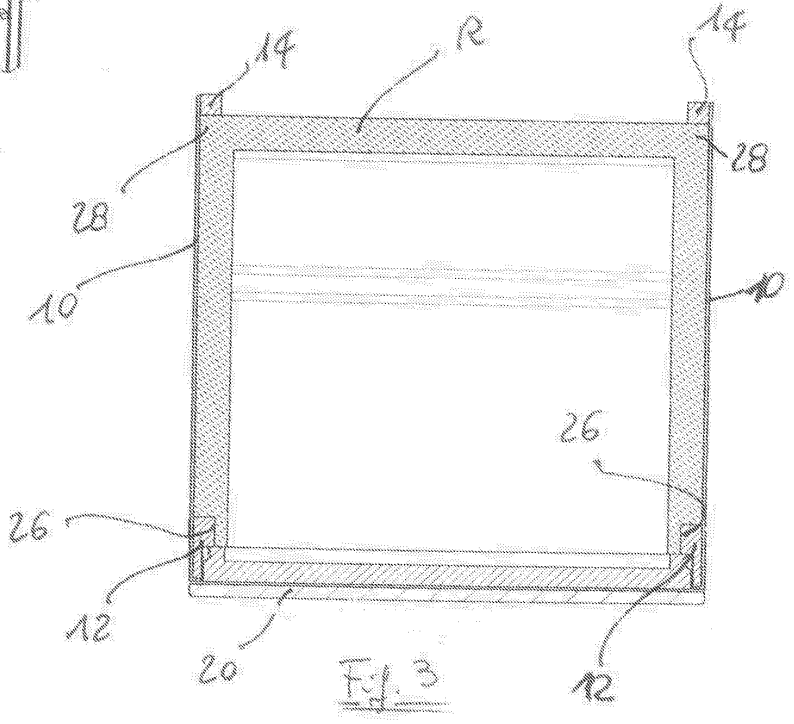

Fig. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 11 6614

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	WO 03/009723 A (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 6 February 2003 (2003-02-06) * page 4, line 32 - page 7, line 9; claims 1-3,6-8; figures 1-5 *	1-3,7,8 4-6	INV. F25D23/10 F25D23/00
Y	US 3 653 532 A (MANN LEONARD J) 4 April 1972 (1972-04-04) * column 1, line 26 - column 2, line 25; figures 1-4 *	4-6	
A	WO 2006/021809 A2 (APPLIED DESIGN AND ENGINEERING [GB]; WOOD IAN DAVID [GB]) 2 March 2006 (2006-03-02) * page 7, lines 18-23; figures 30,37-40 * * page 17, lines 6-16 *	1-8	
A	FR 1 476 903 A (FARGAS FABBRICHE RIUNITE FARGA) 14 April 1967 (1967-04-14) * figures 1,3 *	2-5	

TECHNICAL FIELDS SEARCHED (IPC)

F25D

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
The Hague	9 February 2007	Léandre, Arnaud

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

Application Number
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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-8

European Patent Office

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 06 11 6614

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-8

A refrigerating appliance having increased internal volume owing to vertical rod-shaped elements

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2. claims: 9,10

A refrigerating appliance having an increase internal volume owing to a suspended tray-shaped support fixed at the bottom of the refrigerator body

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 06 11 6614

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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09-02-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 03009723 A	06-02-2003	CN 1535118 A	06-10-2004
		DE 10136222 A1	06-02-2003
		EP 1414324 A1	06-05-2004
US 3653532 A	04-04-1972	NONE	
WO 2006021809 A2	02-03-2006	NONE	
FR 1476903 A	14-04-1967	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82